Notebook Series -- Notebooks by Experimenters Other Than Edison
Navy and Wartime Research Experiments -- A. M. Kennedy Books
Notebook, N-17-10-04.1

This notebook was used by Absalom M. Kennedy during October-November 1917 for notes on experimental work for the U.S. Navy performed under the direction of Edison during World War I. The experiments, which relate to submarine and torpedo detection, focus on how best to encase and tow a detection receiver behind a ship. The tests were conducted aboard the USS *Hydraulic* in Long Island, and efforts were made to avoid interference from other vessels. Included is a transcription of a telegram about the experiments sent to Edison in Washington, D.C. The notes indicate that James M. Burns, John A. Hanley, Joe Meilner, and Sherwood T. (Sam) Moore assisted with the work. The front cover is labeled "Experiments #6 From Oct. 4 to Nov. 2, 1917." The pages are unnumbered. Approximately 120 pages have been used.

Wire used is
B & S #19 -
Plain Pair Pothead Wire, Simplex.

Frank Kuipers
Room 617
Telephone
Mulberry 8100
New Haven
Conn.

75428
Acme Co.,
MFG. STATIONERS,
96 JOHN ST.
AND
19 PLATT ST.
NEW YORK.

Out ✓ ~~Spring Balance reading to 50#~~
x ~~Piano wire for tuning small mach~~
{ Pair low resistance head
{ receivers for use with 1-stage
{ audions

10/4/17.

Measurement of ground resistance of Receiver.

Receiver used yesterday was disconnected from long wire, & put in bucket of water. Showed only 2000 ohms resistance to ground.

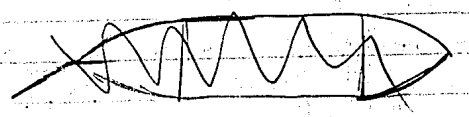
Had Hanley take this one out and put new magnets in case. After assembly, this showed over 1,000,000 ohms resistance.

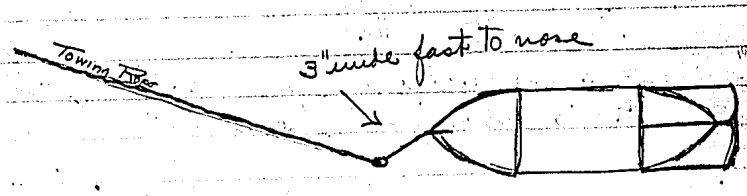
Put in bucket of water over night to see if dampness would affect insulation

R = 937 ω
y = 1000000 +

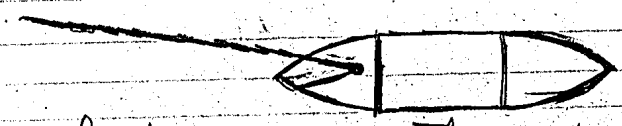
Moore's Model $4\frac{1}{2}' \times 6' = 8\#$
Torpedo Model $3\frac{1}{2} \times 13\frac{1}{2} =$ #

Suggestion to get fins away from metallic body





So as to make depth automatic with pull or strain —



As the pull increases the angle correspondingly increases and goes deeper.

10/5/17

Measurements of resistance of 2nd receiver.

Receiver left in bucket of sea water over night —

Resistance of coils 937 ohms
" to ground more than 1,000,000. "

Hanley will put this in model #2 and smooth up this model for towing.

Engineer getting new pins in links of engine to run smoothly.

These were completed for engines 2 and 3.

Made tests on small wood towing model to try and find better position and shape for side fins. Found that if these fins were carried farther front their size could be materially

#1 – 980 ω. – much wire
#2 – 834 ω – ~~out~~ time.

reduced and the fuel correspond-
-ingly reduced.

Hanby reassembled and
reinsulated resonant.

Coils = 834 ω
Insulation – above 1,000,000 ohms.

Note:

In designing towing models the following points should be observed —

① Model should be balanced in still water so as to normally float on even keel.

② Fins and rudders adjusted so that the forces acting on the model while under way tend to keep it on an even keel.

③ It is evident that the front fins, which counterbalance the upward pull of the rope while at speed, should be as far forward as possible, preferably at the point of application of the rope.

④ The Model should have a slight positive buoyancy but very slight so that the only force required to keep under water will be that of the forward fins pulling against the rope.

⑤ Should have buoyancy on top and weight at bottom to support in stable vertical position.

10/6/17.

Went out with Hydraulic to test engines. More silent. Only one cylinder seems to knock. Will make new pin for this and get knock out.

---

①

Test of #2 Model with Hydrofoils.

① Put model overboard & held horizontal so as to suck out properly and sucked out.

Let out with 400 ft of line. At low speed, about 4 miles per hour was noisy. Heard ① roar - ② crackles - ③ engine noise of which

① = 30°
② = 40°
③ = 30°

This was too much noise. Stopped. Took in and sucked out again. Found that air bubbles come out of case for some time after immersion and these made

quite a loud sound.
After all bubbles had ceased, listened in. Boat stopped. Very quiet.
Rang bell soft away.
Very sensative. Bell loud and overtones beautiful.
Proves that audions and receiver working fine and that noises will be due to some other source.
While in water
Resistance through coils with 850 ft #19 wire 94½ ohms.
Resistance to ground 1,000,000ω +.
With 130 volt Battery showed 3 volts
Stopped for lunch.
Then put out launch to test with bell.
Audions very noisy.
Tested with bridge & found only 200,000 to 300,000ω to ground.

Am afraid we broke down insulation when put 130 volts on it.

It is evident that the resistance of a receiver must be perfect. If any moisture gets in, electrolytic action starts and can be plainly heard. Produces noise and plenty of fit.

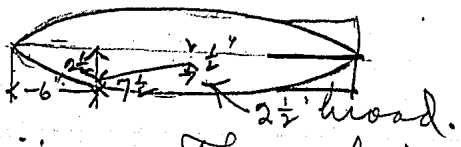
Towed Sail Boat model at 10 miles per hour.
Pull 175 pounds.
Throws wave clear over bow
Nobbles & has immense wake
Too much disturbance.

---

(2)

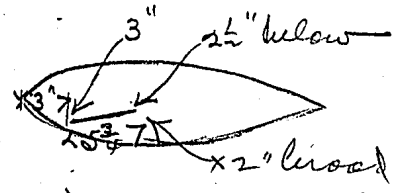
Towing small

(1)



Original. These keel under for 8 ft.

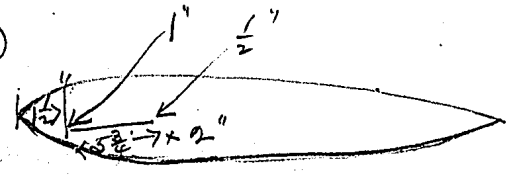
(2)



Towed as deep and weel as (1)

---

(3)



Dives deeper than (2) but quivers.

---

(4) Reduced weight inside to same as small transmitter & fastened

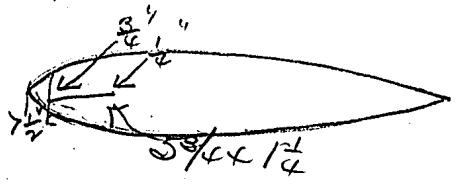
Same result as (3)

---

(5) Same as (3) but ~~cut~~ width of fins to 1¼".

Pull less than (3) & did not dive quite as deep-

(6)



Towed on Hydraulics at 9 mi per hour.
Immersed - dived too deep.
Pull 30#

(7)

Cut fins to taper to shape of front,

Pull reduced to 25#.
Less quiver!
Apparently same depth

(8) Made fins 4" long in place of 5¾. Otherwise same.
Pull = 20#
Little quiver.

(9) Put section 1¾ x 1¼ at same angle as bow fins little aft of amidships.
Very steady. Good depth
Pull = 20#

(10) Put amidships fins off and bent tail fins up.
Pull 40#. Unsteady

Moore left this afternoon. Said he was going to Orange and would be back Sunday night

C213

10/7/17.

(3)

After getting receiver and joints apparently O.K. yesterday went out today to test out.

Put model overboard, held horizontal & pumped water out and saw that all bubbles were out.

Put overboard and listened on audiono. Very quiet but not quite sensative as last test.

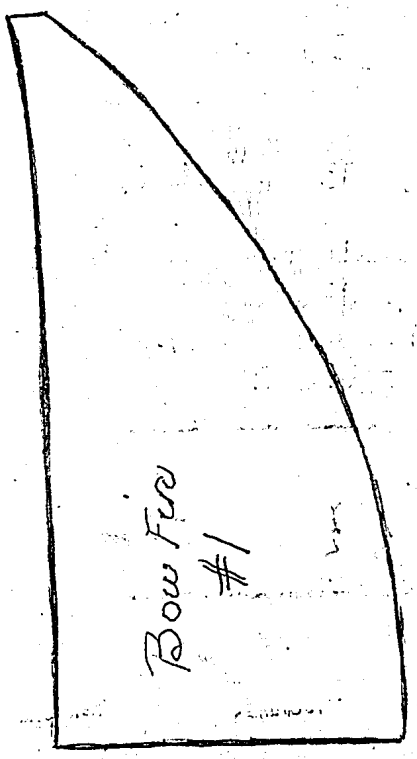
In 10 minutes became noisy. Measuring resistance showed

Resistance of coils 942 ω.
Resistance to ground 270,000 ω.

Will waste time working with this while out. Will make towing tests with this model to get as low resistance and

[23]

as quiet as possible.



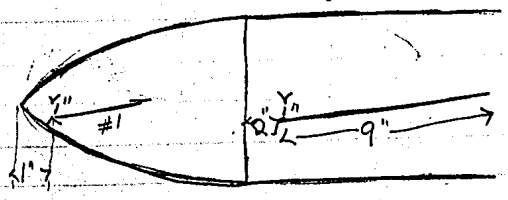
10/7/17

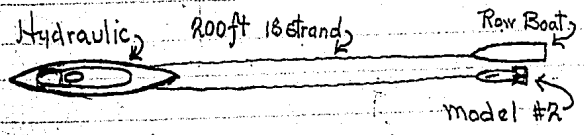
(4)

Towing Tests of Model #2.

Conditions: Towed model with 200ft 18 strand tarred manilla rope.
Towed observer in rowboat at same distance so as to be able to see the model.

A. Left side fins on Model #2 and put on bow fins shaped as shown, on opposite page. Tails straight





Notes A - It is evident that these models must be adjusted for stable equilibrium

B - Evident that when properly placed, small bow fins are much more effective than larger fins placed farther back.

C - These tail fins control the inclination of the whole model. It is evident that by setting them so that the whole model dives the pressure or strain on the front fins may be still further reduced.

D - Proves above

Result Model moved alternately come to surface and dive under about 3 ft. Unstable

B - Took off side fins leaving only bow & stern fins.

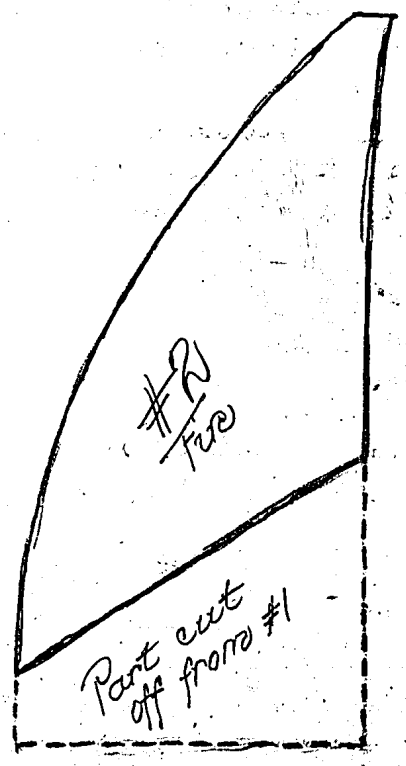
Result Towed steady about 5 ft under surface, but at inclination, forward up, of about 10°.

C - Then bent horizontal tail fins so as to deflect tail upward

Result Dived so deep that we could not see it. Probably more than 8 ft.

D - Changed inclination of front fins to 1/2" in place of 1".

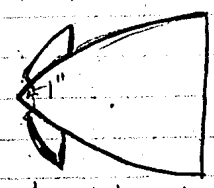
Result. Still dived too deep so that could not see.



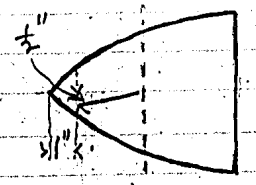
E- Then straightened out rear horizontal fin so as to to give tail only slight thrust upward.

Result Towed about 3 ft under surface almost if not entirely level. Very steady.

F- Changed nose fins to shape 2- less surface. Nose now looks like this from above



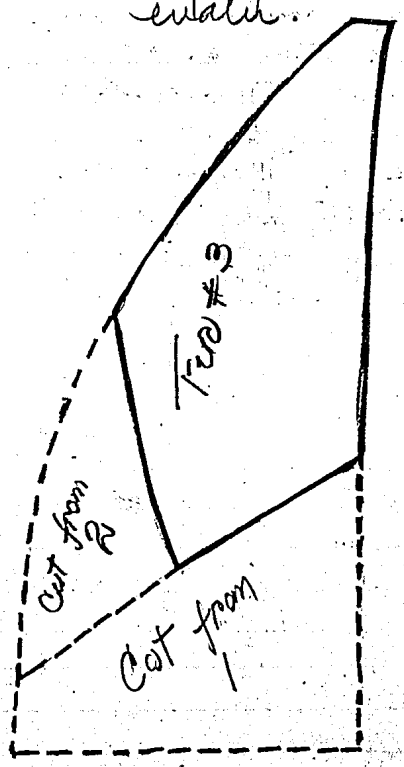
The front of this was 1" (measured on curved surface) from tip of nose.



Result - Unstable. Ran from 3 ft under to surface but on even keel.

Notes G Again proves C

H It is very important to have light at back and water apparently black (no light reflection) in trying to see under water.



G Horizontal rear fins changed so as to force stern upward.

Result Dived too deep, probably more than 8 ft.

H Changed front fins to #3. Also changed rear horizontal rudders to smaller inclination

Result – Could not see model yet inclination of rope seemed to show that it was only 3 or 4 ft under.

Re were now running so that sun was in my eyes as reflected from water when looking at model.

Changed direction of run so that sun was at back.

Real Result Could now see model plainly running about 4 ft under surface on level keel and towing very smoothly.

Notes I.

After adjusting with a certain length of rope, it is evident that if change the length of rope would change the depth. This for two reasons —

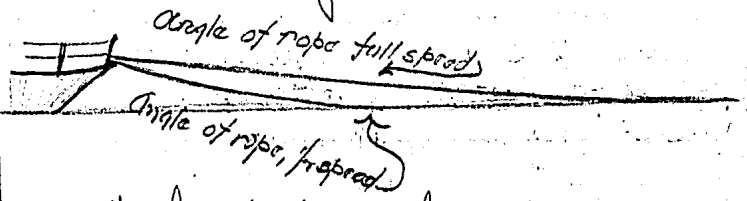
(1) The angle of pull upward by the rope is less

(2) Weight of rope tends to depress nose.

I - Then let out both row boats and model on 400 ft of rope.

Result. Model again dived too deep to be seen. Probably more than 8 ft.

Notes A Does not prove any thing. Apparently resistance does not follow law of square of distance. This is however not disproved by test.



At half speed the rope sags at full speed, straightens out so that less rope is exposed.

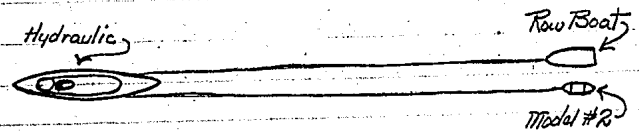
B. With this small front fin, towes fine.

10/8/17.

(5)

Towing Tests with Model #2.

Attempted to complete work of yesterday. Did not have scale to take pull then. One we had rusted. Hanley repaired yesterday afternoon. Got new one in Sag Harbor to check by.



A. Let out 200 ft rope
Half Speed (5 mi hr) pull - 30-35#
Full Speed (9 " ") " - 50-60#

B. Let out 400 ft rope and went back in row boat to observe. Weather very rough so that this was difficult. Required two trials to succeed. Model 2 towed about 5 ft

Notes C-D-E
Seems to show that the pull of rope is directly as the length of rope exposed in water

F Pull of Model 2 alone with small fin is probably 25# or less since some rope was in the water.

C #4 fin has area of less than 2 sq in, is brought forward so that front end is flush with nose and has inclination of 1/2" that is rear is on horizontal middle line while front is 1/2" below this.

under surface and run level,
Pull at full speed, about 9 mi - 110#

C. Reduced front fin to shape #4*
With 200 ft rope, pull = 40#-50# at full speed. (See Note at end)

D. Let out 400 ft rope.
Full speed pull = 125#

E Let out 800 ft rope.
Full speed pull = 205#-215#
Steam pressure 150#
Log = 1 mile in 6 min, 20 sec
= 9.6 mi per hour.

F. To get pull of model alone let out on 50 ft rope.
Pull, full speed = 20#-30#
Pressure 185#
Log = 1 mi 5 min 50 sec
= 10.4 miles per hour.
(Higher speed because of lack of drag).

G. To get pull of line alone, let out 800 ft line nothing on end
Pull = 210# - 220#
Steam pressure 175# to 150#
Log 1 mile = 5 min 55 sec
= 10.2 mi per hr.

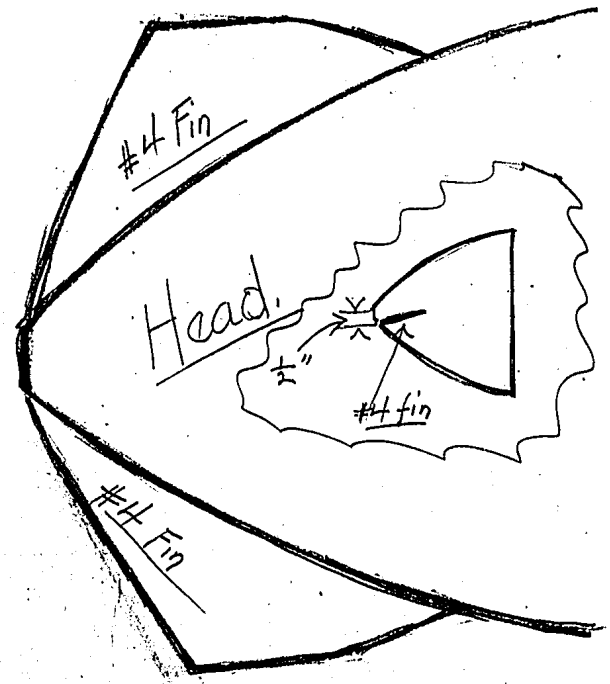
H. Same at slow speed
Pull = 80# - 85#
Log = 1 mile 11 min, 30 sec
= 5.2 mi per hour.

I. Let out 800 ft new steel and copper twisted pair wire.
Pull at full speed = 55#
Steam pressure = 150#
Log = 1 mile 6 min 10 sec
= 9.7 mi. per hour.

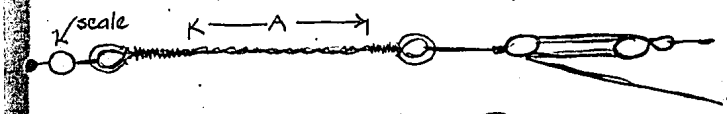
J. Same at half speed
Pull = 15# - 20#
Log = 1 mi in 12 min
= 5 miles per hour.

See next page

Shape of fin #4.



Strain Test of Steel and Copper twisted pair wire.



Pull	Distance A	Stretch.	Remarks
000#	19"	—	
100#	19"	—	
200#	19⅛"	⅛"	
300#	19¼"	¼"	
400#	19¼"	¼"	
500#	19⅜"	⅜"	
600#	19⅜"	⅜"	
650#	—	—	Broke in position A.

Previous tests.

Single wire broke	400#
" " "	350#
" " "	425#
Double " "	375#
" " "	450#
" " "	425#
" " "	400#

Specifications of U.S.A. Field Wire manufactured by the Western Electric Co.

Consists of 10 strands steel wire each .0115" diameter wound around a copper wire .030" diam., the whole being about .050" diam. This is covered with about .130" of very good tough rubber and then covered with braided cotton tarred. The whole wire being about .165" diameter outside.

Test for Noise

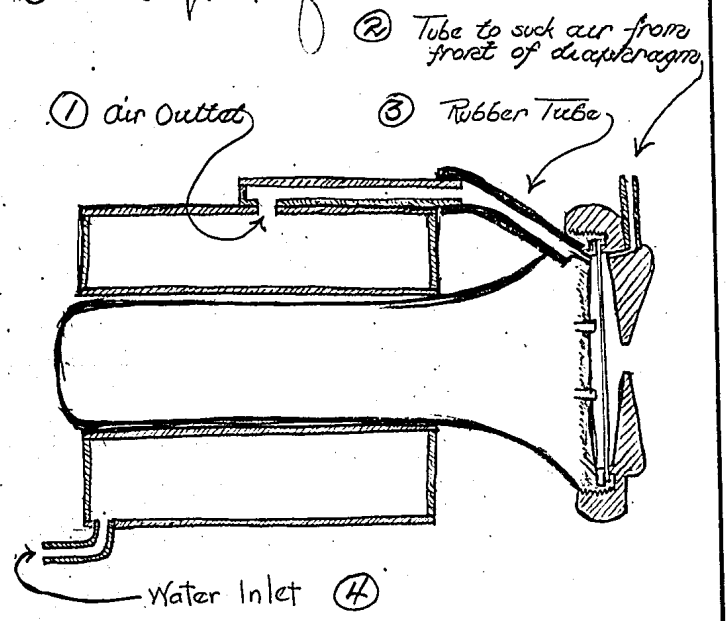
Work on Receivers.

Both 1000ω (.002" wire) receivers, fell down on resistance to ground, measuring 800ω in one case and 400ω in other. The Bell receiver we had been using also showed defective with only about 2500ω to ground.

Hanly then made up air tank for equalizing pressure on diaphragm so that we could use regular Bell receivers for this work and experiment with insulating them. (Sketch on next page)

This proved much more difficult than anticipated and we were not able to absolutely locate where the point of failure was though tests seemed to show from magnet windings or terminals.

to magnet frame.



Air outlet ① is placed in center of cylinder so that water in cylinder will not enter space behind diaphragm should machine be tilted upward or downward.

Test of Bell Receiver in Model #2.

After taking off flexible leads, put rubber coated pot head wire on Bell Receiver. Filled back and front (flush with magnet ends) with Pot Chatterton compound.

Resistance in air showed more than 10,000,000 ohms.

Mounted this in #2 model and sunk near Hydraulic and connected to input of audions.

Output circuit quiet except for legitimate noises (waves, boats etc.)

Went out with Hydraulic to test.

Put out on 400 ft rope, Showed very noisy, rushing sound as of water passing, some engine noise but crackling in addition.

Lets out on 800 ft rope. Noises about same - engine noise slightly less.

Measured resistance to ground. Found about 1200 ohms.

Cut off bat head wires & put overboard.

Resistance more than 1,000,000 ω.

Put reamer in bucket of sea water.

Resistance about 1300 ω.

Took out and dried out. Resistance about 250,000 ω.

Tested resistance of short lead in wires only. More than 1,000,000 ohms.

Pouring ground in reamer.

Filling Bell Receivers with various materials to preserve insulation to ground.

① Bell telephone used in previous test was taken out, Chatterton compound reheated and removed, and new hot Chatterton compound run in place.

Test showed about 10,000,000 ohms. Put outside in water & connected to input of audions. Quiet except for wave and natural noises. Left out an hour. Now noisy - crackles. Tested. Resistance to ground about 1000 ohms.

② Filled Bell receiver with mixture 50% Beeswax (probably not pure) 50% rosin.

Resistance in air more than 1,000,000 ohms.

Put in bucket of sea water.
Resistance = more than 1,000,000 ω.
Left 30 minutes. Resistance
= 2500 ohms.

③ Hanly found apparent trouble at contact with this.
Repaired and refilled with fresh 50% resin, 50% beeswax mixture.
Resistance = 1,000,000 ω+.
Left in bucket of sea water 1 hour
Resistance = 1,200 ω.

④ Dried out. Resistance went back to about 1,000,000 ω.
Vaselined all surface around magnet heads, diaphragm and under surface of cap.
Assembled and put in bucket of sea water 1 hour.
Resistance = 20,000 ω.

(5) Dried out again. Resistance = 1,000,000 ω +.

Covered magnet tips with mixture 50% Rosin, 50% beeswax to depth of $\frac{5}{1000}$" to $\frac{10}{1000}$".

Left in bucket sea water. Resistance = 50,000 ohms.

(6) Made up another Bell Receiver, pouring inside full of heated gutta-percha, facing of outside by magnet tips with thin coating of Chatterton Compound so the Gutta Percha would crumble on surface.

Resistance = 10,000,000 ω +
" after 1/2 hr = 10,000,000 ω +
" " 1 " = 10,000,000 ω +
" " 2 " = 10,000,000 ω +
" " 2½ " = 10,000,000 ω +

Looks good. Will try out.

C.G.J

7

10/14/17-

Towing Test of new receiver.

Hanley's new receiver, insulated with gutta-percha stood overnight in bucket of salt water without breaking down.

Morning fair. Started out to Gardiners Bay to test.

1. Let out 1000 ft twisted pair steel and copper wire and measured each 100 ft & left string for tag.

2. 800 ft of wire out.
   Pull at low speed about 4.5 mi per hr = 28#
   Pull at full speed 10 mi per hr = 90#-100#

3. Connected up to Audions. At full speed, low, loud, musical note, which diminished but slightly at half speed.

Brought in to determine trouble. Found ~~that~~ The air compartment had leaked and was full of water and ~~that~~ we had made a wrong connection to the Andions.

Soldered up air compartment. Put reamer back and smoothed up every thing with putty & Shellack.

At full speed 10mi per hour
full now 70#-80#
Showed roaring, crackling sounds.

On test insulation had fallen to 120,000 ohms.

Took in and found break down in joint.

Weather now very rough.

10/16/17.

Tests for Noise.

Put new 1000ω receiver, which with joints had been in sea water 12 hours, overboard and connected to input of audions. Showed noisy. Test showed more than 1.000.000 ohms resistance.

Connected Bell Receiver with diaphragm off to input of audions. Showed noisy & crackles.

Went over B battery. Found one cell rusted at connectors. Other connectors loose and dirty. Wire connections loose and dirty. Wire of fourth stage to output unsoldered & loose. Soldered, tightened & cleaned up connections. Noise disappeared.

Again put receiver overboard connected to input. Showed quiet except for wave noises. Very sensative with Bob Bell.

Put this in small wood model. Did not balance well stood tail up about 30° in water. Went out with hydraulic. In towing moved dive & dart vertically.

Brought in and changed rear horizontal fins. Dived to bottom and broke off copper front fins.

Brought in and took off front fins and balanced weights so she balanced in water.

Now towed very nicely at from 100 to 400 ft.

Connected to input of audions.

Noisy on low speed
Worse at high speed.

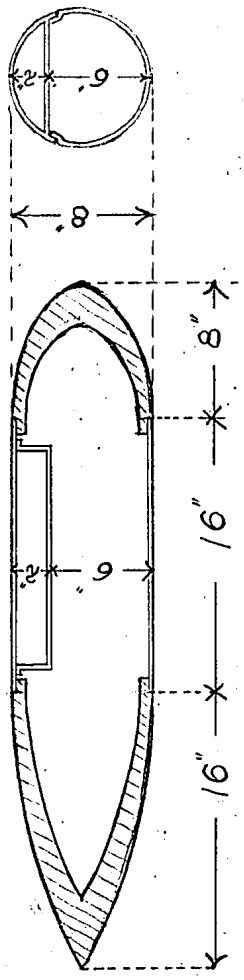
This model has cracks in it and is not perfect. We make noise tests in model more should have ready tomorrow.

Had Jim Burns tape first 40 or 50 ft of USA feed wire so that when model dives to bottom, insulation will not be dragged off.

10/17/17.

Paint dry on Moore's Model 4.
Brought aden to balance up.
On floating in water found nose too heavy. Tried towing. Pulled too much.
Took lead out of lower part of head.
Balanced better.
Moore took back to Mood and Chutes to balance with his micro-phone in.

Marked on Model 3 (made in Laboratory). Air tank leaked. Had to solder up and test several times ~~to get~~ O.K. Now take out tank built integral with body and replace with separate tank which will have 3 advantages —
① Less weight particularly on top where weight isn't wanted.
② Easier to make watertight because easier ~~to~~ get at.
③ Probably not be as subject to leaks because being separate from body not liable to be cracked by



Cross Section, Container #3, Scale 1/8" = 1"

strains to body.

Mounted Bell receiver insulated with Gutta Percha in #3 model. shown on opposite page.

This was equipped with pair of 1/16" galvanized iron tails, full sized diagram on next page.

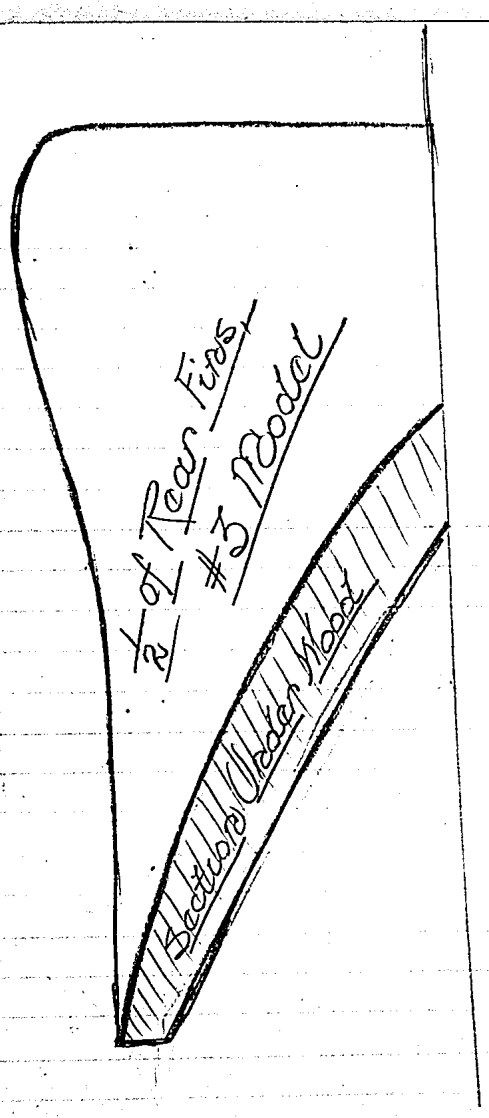
No front fins used in this test.

Receiver sound insulated with rubber sponges.

Preliminary -

Receiver mounted inside. Joints carefully made and piece of rubber tubing slipped over after made.

Receiver and joints then tested out after immersion in water, Showed more than 1,000,000 ohms.


½ of Rear Fins
#3 Model
Bedford Wooden Model

(8)

10/17/17.

Towing and Noise Tests, #3 Model.

No front fins used.

(1) Rear fins left straight. 200 ft U.S.A. Wire let out
Dived too deep. Pull too great.
Model evidently towing nose down

(2) Turned rear horizontal fins up so as to throw nose of model up

With 200 ft wire out, pull less but model came to surface

(3) Reduced upward tilt of rear horizontal fins somewhat.
With 200 ft line, model still comes to surface

(4) Still further reduced upward tilt of rear fins
With 200 ft line rode well at half and full speeds.
With 400 ft rode well at full but went to bottom with half speed.

(5) Bent these fins back about as (3).
Rode well.
400 ft wire out.
Pull at half speed (5 mi) = 30 #
" " full " (10 ") = 60 #

Then connected this to input of audions. Very noisy.
Rushing noise like torpedo.

Then connected Bell receiver diaphragm off to input of audions. Audions quiet.

Then stopped Hydraulic, pulled model in and listened.
Model was now on surface.
Noise of waves very prominent.

These tests as compared with previous on #9 seemed to show:

① That the broader rear fins of Model #9 are better than the narrow fins of #3.

② That no holes are required for sounds to enter these models to reach the resonators. These sounds travel through the sheet iron bodies under water.

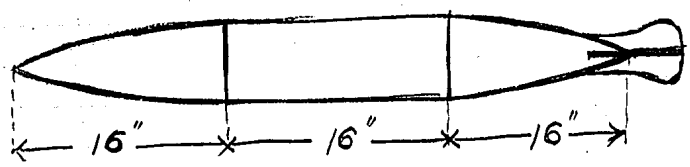
Rote

10/18/17

9

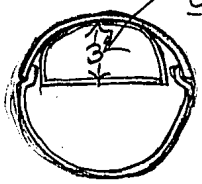
Change of Rose on #3 Model.

Believing ~~that~~ one trouble with #3 model yesterday was too blunt a nose, changed model #3 so as to give sharp nose. This model now measures.



Using the same narrow rear fins of yesterday.

Hanley made new separate tank for this. This tank is made of #24 gauge galvanized metal and is 3" deep



Air Tank of 24 gauge galvanized iron.

Went out with Hydraulic.

① - No low fins. 200 ft U.S.A. Field Wire.

At Half Speed (abt 4 mi per hr) 5#
" Full " " 9.5 " " " 30#-35#

Pull satisfactory light but not as steady as desired.

Connected up to input of audions.

Noise much better than before, a combined roar with sound as of bursting of bubbles - crackling. This however is great improvement over any think previous, except the old wooden model with keel.

② Then let out 800 ft wire

Pull at half speed abt 4.5 mi/hr. hr 22#
" " full " " 9.6 " " " 50-60#

At half speed seems to ride evenly. At full speed, jumps somewhat as indicated by varying pull.

Connected to input of audions. At half speed fairly quiet. At full speed quite noisy - much more so than with 200 ft.

Indicates that the Model is not riding level & even.

Apparently model was diving too deep. Turned back fins to make dive less deep. Came to surface -

Again adjusted these rear fins. Model began jumping as indicated by intermittent

full.

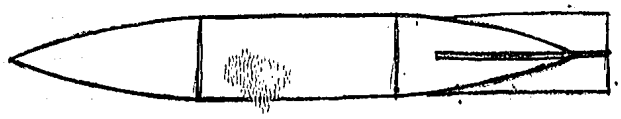
Hanley then put on pair of low fins. - Model still jumped.

Decided to change rear fins to broader ones like #2 model so as to hold more stable. This will be done tonight and try out tomorrow.

9/19/17

(10)

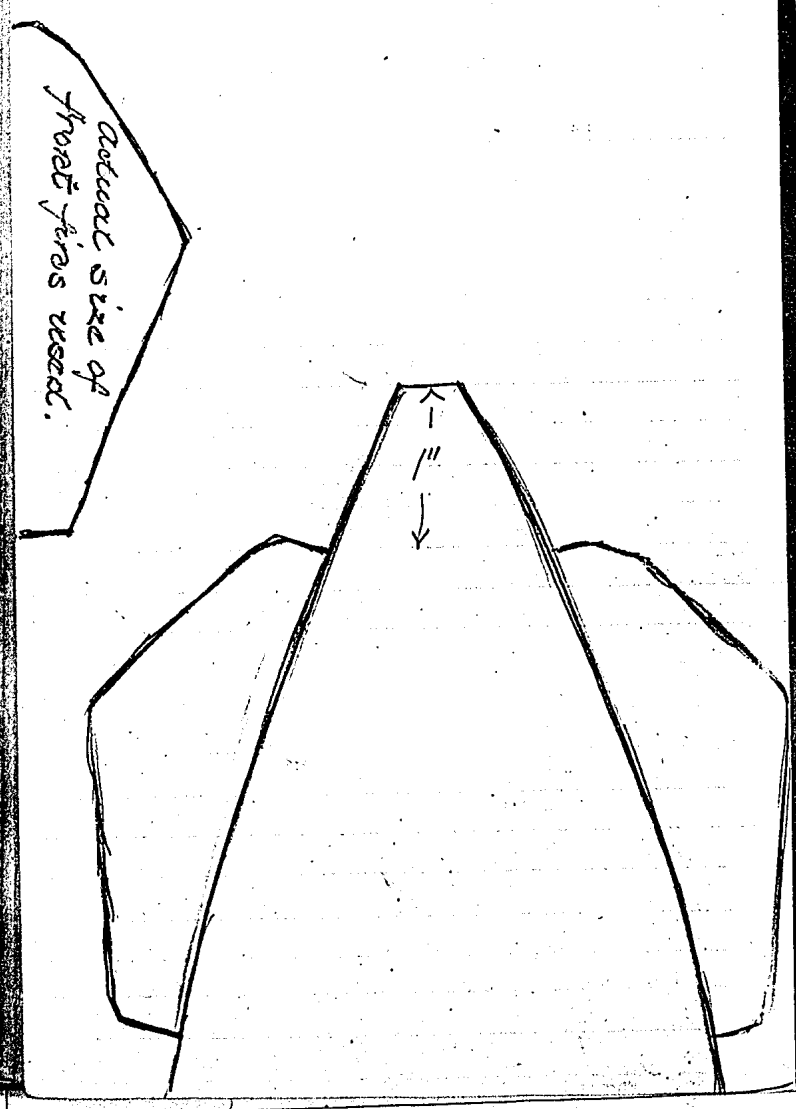
Further Towing Tests with Model #3, using pointed Nose.



Based on experience of yesterday changed rear fins to broader and longer ones, same design as used on Model 2.

While going out to Gardiners Bay on Hydraulic, made some speed and propeller revolution tests as follows—

A. Average R.P.M	127.
" Steam pressure	175#
1 mile in	8min 40sec
Miles per hour	6.9



B. Average R.P.M. 160
" steam pressure 150#
1 mile in 7 min 27 sec
Miles per hour 8.06

C Average R.P.M. 188
" steam pressure 160#
1 mile in 6 min 10 sec
Miles per hour 9.7

Towed Model 3 with sharp head and long tail fins

Weather Very Rough. High wind In Gardiners Bay, waves fully 2½ to 3 ft. White Caps.

① 200 ft U.S.A. Twed Wire out.
Tow Speed (at 9.5 mi per hour)
Pull = 35#
Connected to Input of Audions
Noisy. More than yesterday.
Used front fins shown on opposite page.
Front fins on center line of nose and straight.

(2) Then tilted front fins trifle so as to bring tail up.
With 200 ft wire pull = 80#
Little quieter than before but still noisier than yesterday. Can distinguish engine noise.

(3) Let out to 400' wire
Pull = 50#
Not quite as much noise as (3). Can not hear engine as plainly. Still too much noise

(4) To be sure of audions put Bell received to connections to model.
Audions tested O.K.

(5) Removed front fins
200 ft wire pull = 80#
Little quieter than before.

(6) 400 ft wire pull = 50#
Quieter. This is the quietest to day and compares favorably

with yesterday.

Note Listened in on this at slow speed (about 5 miles per hour) and then speeded up to about 10 miles. Noise increased as soon as engines started, before speed of model increased showing that at least a part of the noise was from the propeller as it did not show periodic engine thump.

(7) Turned rear fins to send nose of model up.
400 ft wire, pull = 55#
Model showed intermittent noise. Came to surface of troughs of waves.

(8) Turned rear fins again to practically straight.
400 ft wire, pull = 45#
Quieter than before.
Believe it is as good as yesterday.

(9) Let out 800 ft wire -
Pull = 65# to 75# with waves.
Listened in. At first loud crackles at intervals but between these, comparatively quiet.
Had speed of boat reduced. Noise correspondingly diminishes.
Again speeded up boat. Carried plainly near acceleration of engines. No crackles. Pull increased to 80# proving that model was going deeper.

This is encouraging as the day is very rough

Took model out of water. Found air chamber crushed in. This accounts for crackles (air bubbles getting out) and the increase in pull.

(10) To see if the wire ~~[illegible]~~ makes noise, short circuited ends & properly insulated and

elt out 200ft.
Audions show quit.

10/20/17.

Burns and Hanly left for Orange.

Made speed test on Hydraulic

Steam pressure 170#, RPM = 72
" " 160, RPM = 66, 66, 66, 64, 62
1 mile in 17 min 30 sec
= 3.4 mi per hour.

Pressure 160 - 127, 134, 136, 137, 137
1 mile = 8 min 15 sec
= 7.25 mi per hour

Pressure 145#, 147
150#, 148, 150
155#, 154.
1 mile = 7 min 40 sec
= 7.9 mi per hour.

Pressure 150#, 179, 180, 180, 180
1 mile = 6 min, 15 sec
= 9.6 mi per hour

Pressure 150# - 185, 186, 186
1 mile = 6 minutes, 0 sec
= 10 miles per hour

Pressure 190# - 202
210# - 211
210# - 212
1 mile 5 min 50 sec
= 10.3 miles per hour.

Curve of this phase ~~straight~~ line to 180 R.P.M. Then falls off

---

To do next week -
Make new air chamber.
Use #3 model with 2000 ft wire & take out to torpedo range

Test out Moore's microphone in model

Charge B. Batteries.

10/23/17.

Hanley and Burns not yet back.
Moore back at work this morning.

Got cork from Eastern Ship. Co. With Frank took to small shop near R.R. station to work up to float for shaping to float for Model #3.

Moore came over and assisted.

In afternoon took Moore's model out for test. He had balanced this carefully so ~~that~~ it was level in water, stood about 1" out with instrument in.

(11)

Towing Moore's model with U.S.A. Field Mere behind Hydraulic

A = 200' wire. Tows steady and will under surface.
180 R.P.M. = 9.6 mi per hour
Pull = 25#

B. = 400' – Tows Steady
40#-50# pull (waves)
@ 9.6 mi per hour. 180 RPM

C. = 800' – Tows Steady
80# pull.
@ 9.6 mi per hour 179 R.P.M

D = 1500' – Tows Steady
180# pull
@ 9.6 mi per hour 180 R.P.M

E = 2000' – Tows Steady
230# pull
@ 9.8 mi per hour 185 R.P.M.

When pulled in found it had dragged bottom due to slopping as bottom of instrument was scratched and wire abraided. also had seaweed and kelp on nose.

Wire was twisted in direction of regular twist. (twisted pair wire) showing ~~that~~ the model had revolved. Believe this was due to kelp on nose

One air chamber nearly full of water, showing bulge out. Other collapsed in.

Allowing about 6# per 100 ft pull of wire and 20# pull of instrument, the calculated and actual readings were (deducting 100 ft in each case for amount of wire in air)

		actual	calculated
200 -	6+20	25	26
400 -	18+20	45	38
800 -	42+20	80	62
1500 -	84+20	170	104
2000 -	114+20	230	134

This rule does not work out exactly probably because at the longer distances the weights of the wire carried the model further down and the angle of the wire to the water is increased.

Believe the collapse of air tanks occurred about the 800'

pull or when we stopped
to lift ~~and~~ 1500 ft.

10/25/17.

Burns back last night

Bad blow night of 23d and almost all day 24th. Rampant anchored in Harbor head until about 1 oam 24th. Because of turning sideways to wind, pulled her anchor loose and went in to Eastern Basin Shp. Bldg. Co dock striking corner of a barge.

We tied her up and though she pounded severely, her thick planking held.

Damage seems to be dent where she struck corner of barge and starting seams above water and paint knocked off. We got off lucky as the wind must have been close to 80 miles per hour.

Moore is making cork floats for his model. Hanley and Burns

changing B Batteries, putting and smoothing up wooden heads of #3 model, testing and cutting off wire damaged in towing Moores model, getting model 3 balanced with new cork float, testing, reinsulating and mounting receiver in #3 model. Will try and get ready for test tomorrow.

Test of Meisser's Receiver.

This was put in bucket of sea water 10/18/27 and tested 71,000,000 ohms.

On test yesterday 10/24/17 showed only about 200 ohms

The magnets of this were wound with .002 wire and given 1 coat of Sterling Varnish and baked. Then filled with Chatterton Compound.

(12)
10/25/17.

Test of Moore's Microphone in Model #4.

Weather - Calm, quiet except last 4 or 5 readings when it began to blow up a little.

Connected up Moore's Microphone to input of 1 stage audion.

(1) Hydraulic stopped. Put overboard and cranked out. Could hear waves slapping it and rolling it. Rang bell to test sensativeness. Could hear bell but not as loud as with Bell Receiver and 4 stage audion.

(2) Let out on 200' U.S.A. Field Wire, stopped engine. Slight intermittent

400' - 10 mile basis = 43.5#
1000' basis = 109#

noise. Tested with bell. Could hear faintly.
Half Speed 94 R.P.M. -
Noisy - bubbles, crackles and roar of rushing water. Had a peculiar blup, blup, regular, periodic sound, 3.2 seconds apart.
Full Speed = 180 R.P.M.
Very noisy. Alternately came to surface and dived!

(9) 400 ft.
106 R.P.M = 6 mi per hr.
Pull = 20# steady.
Noisy. Steady rushing sound.
180 R.P.M = 9.6 mi per hr
pull = 40# steady.
Noise increased and changed but not until boat accelerated showing that this noise was due to speed of model through water and not to engine.

600 ft - 1 mile basis = 74#
@ 1000' basis = 1 ½ 3#

(4) 600 ft.
72 R.P.M = 3.9 mi per hr.
Same steady rushing noise as before
169 R.P.M. = 9. mi per hr
Pull = 60#
Increase of rushing noise after speed has increased.

(5) 800 ft
124 R.P.M = 6.7 mi per hr
Pull = 40#
All noise and sound gradually died out. Tested 1 stage audion with Bell Receiver as transmitter on input. Is O.K. Trouble therefore with the Microphone.

On taking out found small amount of water inside covering all surfaces including the carbon contacts. This seems to be from capillary seepage.

(13)
10/25/17.

Test of Model #3 with cork float.

Made cork float for model #3 in place of air tanks which collapsed. This worked O.K. Held the model nearly an inch more out of water, showing greater buoyancy and did not collapse when sunk.

Receiver insulated with Gutta-Percha which had stood up for 8 or 9 days full down - resistance only 200,000 ω. Put in a receiver insulated with beeswax and rosin which had stood in pail of water for 4 days.

Preliminary Test.
Connected to input of audions, Hydraulic stopped. Showed metallic noise of waves

400 ft - 10 mile bars c. 58.9#
@1000' " = 147#

hitting iron body of model. With Reel showed good and sensative.

Ran at low speed. Noise diminished from surface noise due to lack of banging by waves. Noise almost ceased. Very slight. Not noisy as speed reduced to 0 and it came to surface.

Increased speed to 1/2 Noise diminished.

Increased speed to full. noise diminished to certain point then increased.

(1) 400 ft U.S.A. Full-size,
1/3 speed = 94 R.P.M = 5 mi.
Pull = 20# steady
Increased engine speed. Noise increased before boat got up to speed
190 R.P.M = 9.2 mi per hr.
Pull = 50# steady.
Hear engines. Some rushing noise.

600ft - 10mi basis = 72#
@1000' basis = 120#

Then stopped engine. Noise also stopped before speed of boat diminished much. Had engine started. Noise came up before speed of boat changed.

(2) = 600 ft
R.P.M = 100
Pull = 25# steady.
Less noise than (1). Can hear engine plainly.
R.P.M = 168 = 9.1 mi
Pull = 60# steady.
Noise louder than full speed in (1). Seems to show that the balance of instrument at 400' is best.

(3) 800' ft.
R.P.M = 112 = 6 mi per hr.
Showed intermittent noise and scale jumped showing striking on bottom or other intermittent resistance.
Pulled Model In to examine.

C1317

400 ft Cork floats - 10 mi hour 50#
@ 1000' hour = 125#

(4) Turned rear horizontal fins up slightly so as to keep nearer surface.

~~200 ft~~ = Stop quiet.

R.P.M. = 124 = 6.6 mi per hr.
noise increased slightly
Hear engine.

RPM = 180 = 9.0 mi per hr.
Intermittent noise. Comes to surface & dives.

(5) ~~400 ft~~. Cork floats on wire at 200' & 300'

68 R.P.M = 3.6 mi per hr.
Pull = 12.5#

Very quiet. Hear only engine noise and that plain

168 R.P.M = 9.0 mi per hr
42½# steady pull.

This is good. Corks have diminished rather than increased pull.

400 ft - 10 mi basis = 51.6 #
@1000' basis = 129 #

600 ft - 10 mi basis = 85.2 #
@1000' basis = 142 #

(6) Then increased corks so as to have at 200'-250'-300'-350'
400 ft
106 R.P.M. = 5.5 mi per hr.
20 # = steady pull.
Steady noise. Heavy engine.
180 R.P.M = 9.6 mi per hr
45#-50# = pull. not steady
Showed intermittent noise!
Comes to surface & dives.
Good shows we can control depth at greater distances

(7) - 600 ft. Additional corks every 50'
173 R.P.M. = 9.4 mi per hr.
75# = steady pull.
Noise increased. Rattles.

(8) Back to 400' to determine trouble
At half speed very noisy showing something had happened.
Pulled in. Model had nose full of seaweed and kelp.

400 ft - 10 mi basis = 52.3 #
@ 1000' basis = 131 #

600 ft = 10 mi basis = 83.3 #
@ 1000' " = 139 #

800 ft - 10 mi basis = 100 #
@ 1000 ft basis = 175 #

(9) Cleared off.
400' with corks each 50'
123 R.P.M = 6.6 mi per hr
30 # pull. Steady.
Very nice & quiet. Hear engine plainly
172 R.P.M = 9.3 mi per hr.
45 # = pull steady
Noisy. Came to surface. Good

(10) 600 ft. corks each 50 ft.
98 R.P.M. = 5.3 mi per hour
27.5 # = pull steady.
Quiet
178 R.P.M = 9.5 mi per hr
75 # = pull steady
Quiet

(11) 800 ft. No more corks.
104 R.P.M = 5.6 mi per hr
40 # = steady pull.
170 R.P.M. = 9.2 mi per hr.
85 # = steady pull.
At 104 RPM. almost all engine noise. at full speed still hear engine but other sounds also. Had engine stopped

1000 ft - 10 mi bars = 117#
@ 1000' = 117#

600 ft - 10 mi bars = 87.2#
@ 1000' " = 145#

While noise was up, still some noise

(12) - 1000 ft. No more corks.
130 R.P.M. = 7 mi per hr.
60# = pull
Increased noise. Crackles.
182 R.P.M = 9.7 mi. per hr.
110# = pull.
At first noisy & pull varied between 100# & 120#. Then quieted down and pull showed 110# steady.
Still extraneous noise at more than 600 ft.

(13) - 600 ft - same as (11)
118 R.P.M = 6.4 mi per hr
32½# pull = steady
172 R.P.M. = 9.3 mi per hr.
75# pull = steady
Noisier both at half and full speed than (11). Something wrong.

Test showed resistance to ground = 145,000 ohms. This proved to

be in joint.

10/27/17

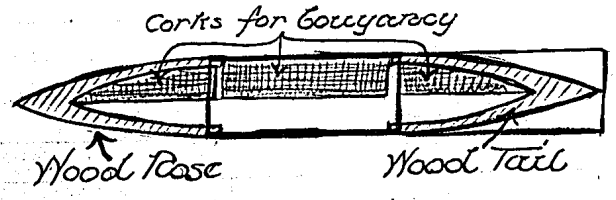
Galvanometer for bridge gone bad so can not test resistance

Put corks in tops of nose & tail of Model 3 00 as to increase bouyancy.

Put in receiver (wave & coin insulation) and connected up.
Shows very quiet on actions but can hear well plainly & with all overtones.

(14)

Test of Model #3 with corks in for extra bouyancy.



Detail-fastening cork floats on U.S.A. wire.

C1453

① 600 ft wire. Corks at 100', 200', 300', 400', 500'.
At half speed, noisy. Rushing crackling, bubbleing noise.
Stopped Engine. Noise continued with speed of boat.
Full speed
174 R.P.M = 9.4 mi. per hr.
60# pull = steady
Still very noisy.

② Then took all corks off to get conditions of yesterday.
124 R.P.M = 6.7 mi per hr.
Still noisy. Can hear engine but there are additional noises.
166 R.P.M = 8.9 mi per hr.
Still noisy. Noise changes and increases with speed.

③ Put corks back again as ①
98 R.P.M - 5.3 mi per hr. 45#
While speed was increasing from 0 to 5.3 mi per hour, there was a time, lasting a

few seconds when extraneous noise died away entirely and the engine sound was the most prominent.

172 R.P.M. = 9.3 mi per hour
105# pull first = steady
120# " = "

As above, at an intermediate speed between half and full, there was a point lasting a few seconds where there was very little extraneous noise.

This no noise point appears to occur only during a change in speed and not at any fixed rate of speed. It seems to occur then when in the process of getting a stable position for towing the model has gotten into some position where there is least friction or resistance or swirl or whatever, it is that produces this noise.

④ – 1500 ft wire – 14 cork floats.
at low, uniform speed, about
2 mi per hour, very noisy shad.
128 R.P.M. = 6.9 mi per hour.
95# pull = steady.
noisy
While accelerating to full speed,
model came to surface was
noisy.
180 R.P.M = 9.6 mi per hour
155 # pull = steady.
noisy.
Then dropped back to
intermediate speed to see if
different –
156 R.P.M = 8.4 mi per hr
125# pull = steady
Still noisy.

Pulled model in. Found long
piece of kelp on nose.
This would destroy towing
equilibrium and make
noisy.

(5) Let model out 40 ft and observed at various speeds from towed boat.
124 RPM = 6.7 mi per hr
30# = even
174 RPM = 9.3 mi per hr.
50# = even
At lower speed towed bow up but at lower speed would ride perfectly level. This seems to confirm listening in experiments where it sounded best at an intermediate speed. The model probably was running on even keel and quick least eddy currents at this speed.

Then bent the rear horizontal fins to perfectly level and again observed. Same results. Just at changeing speed for a few seconds. Noisy at fixed speeds.

These experiments seem to indicate that extra work

produces an excess buoyancy due that the extra pull necessary to keep model under water produces swirls which make the noise.

~~146 R.P.M. = 7.9 mi per hr~~
~~40# pull = steady~~
~~noise~~
~~170 R.P.M. = 9.2 mi per hr~~
~~50# pull = steady~~
~~noise~~

(6) Extra corks removed from nose and stern.
400 ft mile. Cork floats every 50 ft
146 R.P.M = 7.9 mi per hour
40# pull = noise
170 R.P.M. = 9.2 mi per hr.
50# pull = noise.

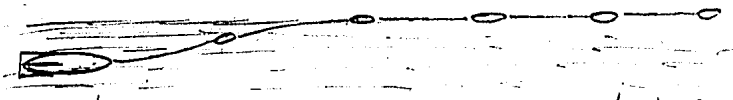
(7) Then changed cork floats to every 25 ft apart
172 R.P.M. = 9.3 mi pr. hr.
55# pull = steady.

at half speed rhythmic clicking in mixed other noise. at full speed, same rhythmic clicking but more rapid. Extra cork floats evidently making boat ride heavier surface and these clicks are ripples.

(9) Then took off the 25 ft floats leaving only at 50' intervals
116 R.P.M = 6.3 mi per hr.
30# pull = steady
noisy
167 R.P.M = 9.4 mi per hr
50# pull = steady
still noisy.

(10) Again put back 25' interval floats to try effect
110 RPM = 5.9 mi per hr.
25# pull = steady
165 R.P.M. = 8.9 mi per hour.
50# pull = steady.
Both noisy.

Hanley went back in row boat and found following floating.



He then made several trials and balanced model.
Noise much reduced pretty good.

While at this adjustment determined to load it and try out with torpedoes Monday.

1.3
5.2

Rheostat for total battery amount
Try 3 stage audion

Joseph Martin

10/29/17.

Tests with Model #3.

Connected up #3 model with Beeswax & Rosin insulated receiver. Tested out. Is very quiet.

Resistance test to ground shows only 200,000 ohms. This is bad but testing conditions are too good to miss.

Put out bell in row boat. While under way at about 5 miles per hour could hear bell plainly at 200 - 300 yards.

Went to Gardiner's Bay and ran parallel with torpedo course to get torpedoes.

At 136 R.P.M. audions quiet. Found however that current through the filiments was low and that this made the circuit unusually quiet. Put on new battery and brought

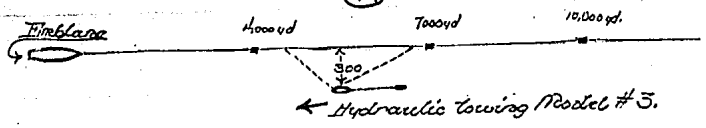
filiment current to 1.3 amp. at 136 R.P.M = 6.4 mi per hour somewhat noisy. At 106 R.P.M. = 5.6 mi per hour, somewhat quieter. Cut down current in 1-2-3 stage audions. Became then fairly quiet.

Moore put his instrument overboard also.

(15)

Test of #3 Model with Wax and Rosin insulated Receiver

(A)



400 ft of wire out. Corks at 25'-50'-100'-150'-200'-250'-300'-350'
Speed = 110 R.P.M. = 5.8 mi. per hr.
First heard torpedo at 500-600 yds.
Loud " 300 yards.
Heard to 700-800 yds.

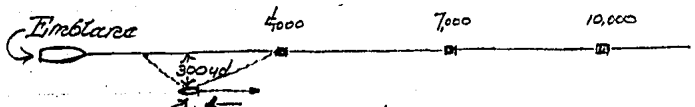
Based on these, telegraphed as follows:

T.A. Edison, Civil Board Rm., Navy Dept.
Washington, D.C.

First test on range heard torpedoes plainly five hundred yards three trials while under way six miles per hour towing Bell model at four hundred feet. Heard with microphone model also. Sea Rough

A. McKenney.

(B)

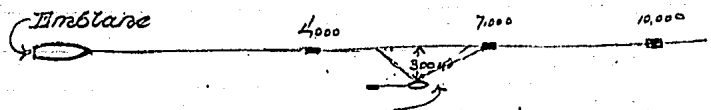


Hydraulic towing model #3.

Same length wire and corks as (A).

Speed = 112 R.P.M. = 6 mi per hour
First heard torpedo at 500-600 yds.
Loud at 300 "
Heard to 1000 "

(C)



Hydraulic towing Model #3.

Wire and corks same as (A)
Speed = 130 R.P.M. = 7 mi per hr.
First heard torpedo at 600-700 yds.
Loud at 300 "
Heard to 1200 "

Very Encouraging.

Weather Rough. Mowry White Corps.
So rough that Emblane came in.

Variation of Noise with Speed.

(A) 200' - Corks 25-50 and each 50
96 R.P.M. = 5.2 mi per hr.
Quiet at first. Became noisy

(B) 400' - corks each additional 50',
98 R.P.M. = 5.3 mi per hr.
Less noise than above

(C) 600' - corks at each additional 50'
102 R.P.M = 5.5 mi per hr.
Less noise than above. Engine plainer

(D) 800' - small corks each additional 50'
100 R.P.M = 5.4 mi per hr.
Very noisy. Must be dragging bottom

(E) 800' - as above
142 R.P.M. = 7.7 mi per hr.
Much quieter than above. Can hear engine.

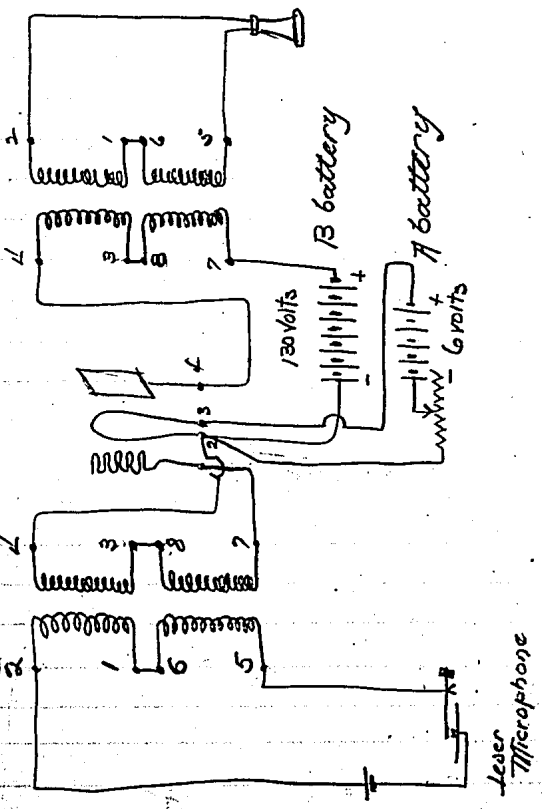
F - 800' - small corks each 25' after 600
82 R.P.M. = 4.5 mi per hr.
Quiet. Good

(G) As above 130 R.P.M. - Noisy

(H) as above 174 R.P.M. Increased noise

(I) 200' - corks at 25' - 50' each 50 thereafter.
178 R.P.M. Quite noisy.

Connections for Microphone and One Stage Amplifier.



10/30/17.

Blow yesterday afternoon increased and developed into storm and rain which lasted all day.

Shaffner came last night. Spent day with him going over apparatus, and situation concerning The Rampant.

Hanley tested out joints. Found resistance about 200,000 ohms. Made new joints.
Also made drawing for 6" wooden towing mast.

Burns made another air tank for Bur. Receiver so that we could have spare one already set up.

Shaffner left 2:50 for Orange to get list of new material wanted.

10/31/17

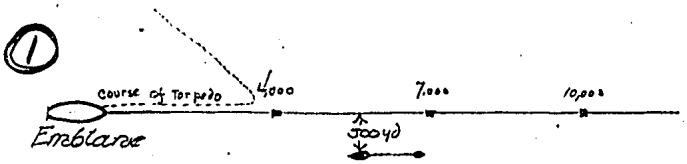
Further Tests of #3 Model with Torpedoes.

Weather: (16) First torpedo (3)
Calm. Others some wind & white caps. Waves about 12".

Missed first torpedo. Too noisy and too sensitive. Hanley thought he could just detect. This was taken at full speed. 180 R.P.M. and with all audion tubes with full current 1.3 amp through filiments.

Reduced filiment current of the first 3 stages and speed to 112 R.P.M = 6 mi. per. hr.

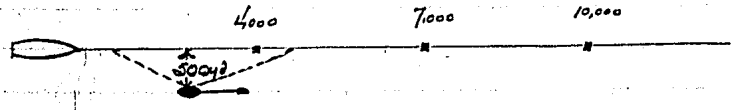
(1)



Torpedo fired. Ran straight almost to 4000 yd depth then turned and went back toward Emblane.
Moore stated that he heard this. Impossible

(2) While waiting for next torpedo to be fired tried resonating receiver on audiono in place of head receivers. Found that at 98" it made the noises louder – being a resonant point probably for the audion circuit.

(3) Weather Cairns:



600 ft U.S.A. field wire with corks at 25-50-100- & every 50 ft thereafter.

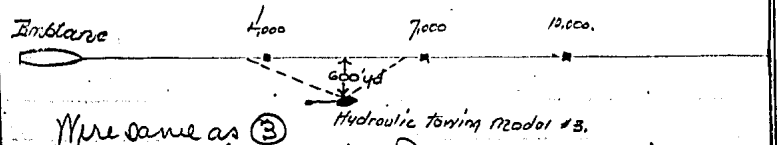
Speed = 130 R.P.M = 7 mi per hr
Hanley listening
First heard Torpedo at 2000 yds.
Loudest 500 "
Heard to 3000 "
This seems too good to be true.
Hanley reiterated that he was sure of his mosquito.
Moore heard this —

Audions then became more noisy. Pulled model in and could find nothing wrong except seamed on corks. Put in water again. At first quiet but soon again became noisy. Experimented with current through filiment of audions and found that this noise varied as the current through the filiment of the 3rd Audion. This is the one having the grid charging battery removed. Varied currents of this until circuit was sensitive but not noisy. Also reduced potential

of B battery from 144 to 130 volts.

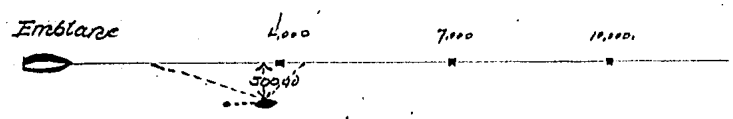
Tried again speeding up to 180 R.P.M = 9.6 mi per hr. Model becomes noisy around this speed and unfortunately the noise is a screeching whistle very similar to the sound of a torpedo. This shows that our model must be further refined for high speed.

④ Weather little rough. Some white caps. About 12" waves.



Were same as ③
Hanley listened & confirmed.
Speed = 120 R.P.M = 6.4 mi. per hr.
First heard torpedo at 2000 yds.
Loudest 600 "
Heard to about 1500 "
Moore heard this also. I confirmed.

(5)



Hydraulic Towing Model #3.

Same wire and corks as #3
Hanley listened. I confirmed.
First heard torpedo 2000 yds.
Loudest 600 "
Heard to 1500 "
Weather somewhat rough. White caps. Waves about 12" high.
Speed = 140 R.P.M = 7.5 mi per hr.
Moore heard this
Model shows intermittently noisy. Am unable to determine exactly why but imagine it collects floating grass and seaweed which destroys balance and makes it run irregularly.

(6)

Hydraulic Towing Model 3.

800 ft wire out. Corks 25-50-100 and each 50 ft to 600.
Speed = 72 R.P.M. = 3.8 mi. per hr.
We did not know Torpedo was coming when Hanley announced that he heard it. About ½ minute after it passed the 7000 yard barge which was 2500 yds from us, showing that he had heard it about 3000 yards. Continued to hear until about 2000 yds passed us.

Emblane then went in.

(A) Speed = 140 R.P.M = 7.5 mi per hr.
Noise fair. Could distinguish Torpedo
800 ft wire out

(B) Same wire.
Speed = 176 R.P.M. = 9.4 mi. per hr.
Noise worse. Torpedo like.

Could not distinguish torpedo at this speed.

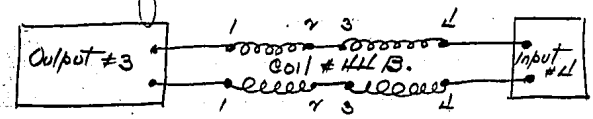
It is evident ~~that~~ we will have to improve towing model to eliminate noise at higher speeds.

11/1/17.

Tests of Model #3 for Noise with Torpedoes.

(17)

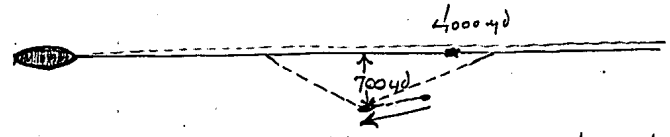
Left Greenport about 7:45 am. On way out tried putting inductance in audion circuit between 3d and 4th stages in attempt to lower the electrical frequency of the audion circuit so that its note in the receivers would not be like the high pitched note of a Bliss Torpedo



This coil had no effect on pitch of audion noise.

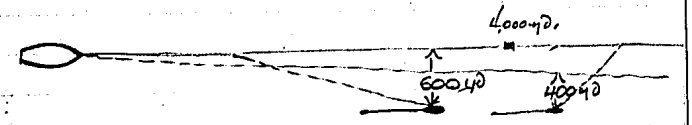
Adjusted current through filiments of 1st, 2nd & 3 stage audion bulbs so as to reduce noise, paying especial attention to the 3d stage which seems the most sensative.

(1)



400 ft wire out corks 25'-50'
100' each 50' thereafter.
112 R.P.M = 6.0 mi. per hr.
Hanley heard torpedo first 1000 yd.
Loudest = 700 yd.
Heard to 2000 yd.

(2)



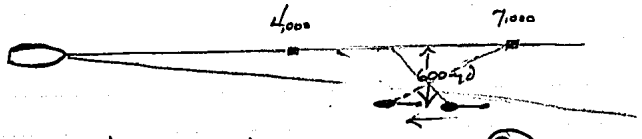
600 ft wire out. Corks 25'-50'
& each 50' thereafter.
Speed = 102 R.P.M. = 5.5 mi. per hr.
First heard = 2000 yds
Loudest = 00 "
Lost at 1000 "

Took model in and greased with vaseline to see if would decrease resistance and eddy-currents and noise.
Seems to have no effect.

③ While engaged in letting out model after this, torpedo was fired which ran off course and came in about 50 yards of us.

Speed = 74 R.P.M = 4 mi. per hr.
Hanley and I each having pair of head telephones heard very loud when near and for 3000 yards after it passed us.

④

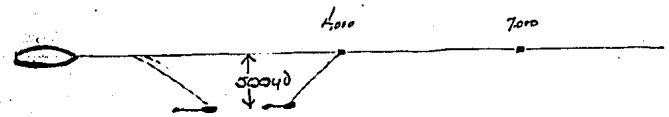


Same wire and corks as ②
Speed = 130 R.P.M = 7 mi. per hr.
Hanley and I both listened in
Torpedo ran off course and came in 100 yards of us.

First heard at	1000 yd
Loud	100 "
Could hear	2000 "

Audions somewhat noisy.

(5)



Same wire and corks as (2)
Speed = 156 R.P.M. = 8.5 mi per hr.
First heard = about 1000 yds.
Loudest = 500 "
Heard to = 1000 "

This torpedo was not loud or clear like the others. Very difficult to distinguish. This is not new, however as we sometimes had similar results while testing before.
Also the higher speed increased noise.

Have not heard to day as well as yesterday. Will try and adjust 3d stage audion as sensitive as possible to stand the noise.

C191J

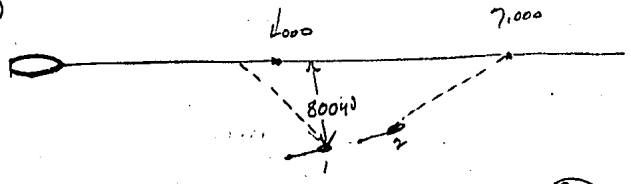
This shows that this method of mounting the Bell Receiver as transmitter method of insulating ~~and~~ is better than formerly and that the audions are O.K. and very sensative.

Steamer Montauk passed 3000 yds off. I heard her engines – Berchuk – Berchuk Berchuk, 95 R.P.M. Very loud.

This sound however is quite different from noise of torpedo and would not confuse.

Emblem passed going in at 2000 yards. Could not hear exactly as well as Montauk at 3000 yds.

(6)



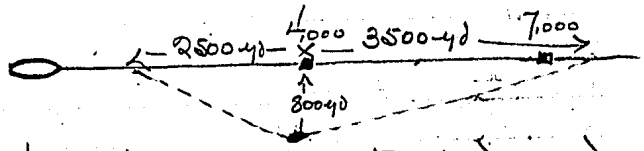
Wire and corks same as (2)
Speed = 134 R.P.M. = 7.2 mi per hr
First heard = about 1500 yd.
Loudest (very) " 800 "
Heard to " 1500 "
Listened in also with resonator receivers. Thought I could get a response at about 6" but not sure.

This torpedo came to surface with a splash just before 4000 yd and ran some distance with nose out of water

Was much louder and plainer than #(5).

Took model in and removed cork at 25' to make ride a little deeper.

(9)



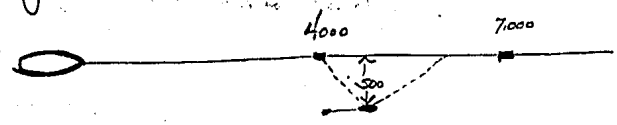
Had Hydraulic stopped and float taken out of model so as to sink it. Model sunk about 12' over stern. First heard torpedo in 1½ minutes after left Emblane or at 2500 yds from 4000 yd post or about 2625 yds from Hydraulic. Heard for at least 500 yds past 7,000 yard scow or for nearly 4000 yds from Hydraulic.

This is much better than one used to hear with old horn & tripod model although there is more noise from banging against boat.

The sound is clearer & louder & better.

Torpedo came by unexpectedly. Neither Stanley on ear phones nor self on resonating resonators detected it. Tried to get resonance but could not get anything definate.

(7)



Wire and corks same as (2) except cork at 25' removed.

Speed = 180 R.P.M. = 9.6 mi. per hr.

First heard torpedo = about 600 yd.

Loudest = 500 "

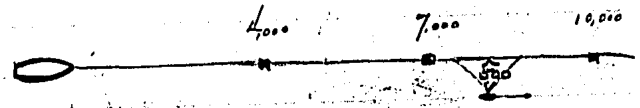
Heard to = 1000 "

Listened in on resonating resonators. Could not tune or get anything definate with them.

At this speed there are three separate classes of noise

(1) A low frequency, non-periodic Br-br-br-br- non musical noise which I believe to be due to eddy currents, either

(8)



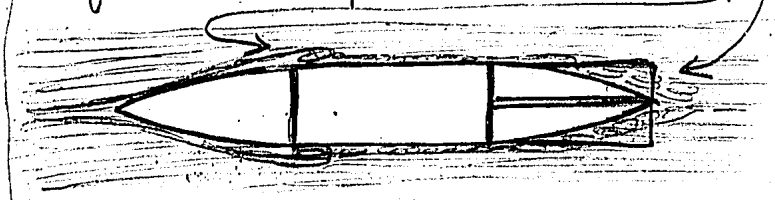
Wire and corks same as 7.
Speed = 180 R.P.M = 9.6 mi per hr.
First heard torpedo about 600 yd
Heard torpedo to 1000 "

It is evident that reducing the sensitiveness of audion to reduce noise is wrong as it cuts down all sound, legitimate as well as noise and that we need as much of the torpedo sound as we can get.

Then adjusted all audion bulb filament currents to 1.3 amp so as to bring up to maximum sensitiveness.

---

at the tail or at the intersection of the head piece with the body.



(2) A musical note resonating to about 9" air column. Believe this to be the electrical frequency of the audion circuit which resonates with (1) Later results shows also propeller noise of Hydraulic.

(3) The higher pitched screeching whistle of the torpedo.

Then reduced sensitiveness of audions to get rid of noise by this means.

---

follow opp. pages

For 11/2/17.

(1) Compare 4 stage and 1 stage audions

(2) Shunted receiver & heel test
shunted receiver nearest to
source of sound

(3) Try 3 stage audion experiment
against 4 stage

get D.P.D.T. Switch

1- Container for goes to R f32 - ½ sec
2- " " " " "
3- Summit Sig Illu. f6.5 = 1 sec
4- Container mounted on board
5- Mark model f16 - 1/30 sec
6- " " " "
7- Same front view f32 - 1 sec
8 - Model #2 f32 - 1 sec
9 - " 3/4 rear f32 - 1 sec
10 " Microphone on keel f16 - 1 sec
11 " Keel Board Model f16 - ⅛ sec
12 " Model #2, small fins f16 - ⅛ sec

C2417